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(54) Title: A WATER-DISPERSIBLE BODILY LIQUID ABSORBENT COMPOSITE			
(57) Abstract <p>A water-dispersable bodily liquid absorbent composite comprising a bodily liquid absorbent core and a backing layer which is applied, in use, to at least one face of the core and has no continuous substantially water insoluble barrier therein or thereon and which layer is directly rapidly soluble in cold water without addition of any other agents to induce or enhance solubility but insoluble in viscous low volume bodily liquid discharges, including menstrual fluid, blood and breast milk especially, and being selected from the group consisting of: polyvinyl alcohol hydrolysed to a level of between 90 % and 98 %; alginate; ethyl cellulose; hydroxypropylcellulose; methyl hydroxypropylcellulose; and hydroxy methyl cellulose.</p>			

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## **A WATER DISPERSIBLE BODILY LIQUID ABSORBENT COMPOSITE**

### **Field Of The Invention**

5 This invention relates to the field of bodily liquid absorbent composite products, in particular catamenial devices such as sanitary napkins, and breast pads and wound dressings. All being products for absorbing relatively viscous and low volume bodily liquid discharges or exudates.

### **Background To The Invention**

10 Disposable bodily liquid absorbent products have become the subject of much criticism regarding the environmental consequences associated with their disposal. Frequently the ultimate destination is land-fill, which is itself a limited resource. Suggestions that disposable products should be placed in bags and then disposed of in land-fill clearly makes little long term environmental sense. Other concerns about the biohazard risk in transportation of clinical waste including blood products have highlighted the  
15 extent of the problems associated with the fate of these items.

20 These problems stress the need for disposable products which can be disposed of by other routes to land-fill where minimal contact with the contaminated used products occurs. In addition it would be particularly beneficial to the environment if such products were biodegraded rather than persist in their ultimate disposal site. It is these general requirements that this patent application seeks to address.

From the transportation perspective, the most convenient route for disposal of such products is via the sewerage system, thereby avoiding the need for human contact with the waste. Inevitably, however, disposal via this route heightens the acuteness of need for dispersion of the waste.

- 5 Various proposals have previously been put forward to overcome the difficulties of disposal of such products.

10 Referring to United States patent number 4,372,311 in the name of James E Potts, this discloses construction of disposable articles such as sanitary napkins from a water soluble polymer coated with a thin layer of a biodegradable water-insoluble polymer, with the water-insoluble polymer coating providing a water resistant barrier layer. The product is stated to be suitable for disposal in a waste-water sewerage disposal system but relies upon biodegradation for the barrier layer to disperse and presents risk of clogging of the sewerage system.

- 15 A further proposal has been made in the United States patent number 3,952,347 (Comerford et al) to provide bodily liquid absorbent composite products such as sanitary napkins and diapers with a biodegradable barrier film that is wholly water-insoluble or slowly soluble in water. Again, full dispersal of this product is dependant upon the rate of biodegradation of the barrier layer.
- 20

Although biodegradation may begin to occur shortly after introduction of the waste product into the waste water system the rate is inevitably dependant upon the presence of the requisite bacteria, the rate at which they may colonise the substrate and the rate at which they are capable of catabolising the material. Much of their digestive action is likely to occur downstream at the sewerage processing plant rather than in transit in the sewerage system presenting a risk of upstream accumulation of undispersed waste.

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It is an objective of the present invention to provide a water dispersable bodily liquid absorbent composite for absorbing relatively viscous and low volume bodily liquid discharges and having a barrier layer to prevent leakage

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of those discharges from the product during use but which is safely and efficiently disposable in a waste water system and which overcomes the problems of the aforementioned prior art proposals.

#### Summary of the Invention

5 According to a first aspect of the present invention there is provided a water-dispersable bodily liquid absorbent composite comprising a bodily liquid absorbent core and a backing layer which is applied, in use, to at least one face of the core and has no continuous substantially water insoluble barrier therein or thereon and which layer is directly rapidly soluble in cold water  
10 without addition of any other agents to induce or enhance solubility but insoluble in viscous low volume bodily liquid discharges, including menstrual fluid, blood and breast milk especially, and being selected from the group consisting of: polyvinyl alcohol hydrolysed to a level of between 90% and 98%; alginate; ethyl cellulose; hydroxypropylcellulose; methyl  
15 hydroxypropylcellulose; and hydroxy methyl cellulose.

For this purpose where the material for the backing layer is polyvinyl alcohol it is suitably hydrolysed to a level of no less than 95%.

In this case, it is desirable also to use a plasticiser such as, for example, glycerine in an amount of between 5 and 29% and preferably approximately  
20 25% of the dry weight of the backing layer. The film forming the backing layer is preferably less than 100 microns thick and of the order of 20 microns thick. Where the backing film consists of 75% polyvinyl alcohol, by using 22% glycerine plasticiser additive together with 3% surfactant additive optimal handling characteristics of the film are achieved.

25 By way of further definition of solubility in cold water, it is reasonable to say that the bulk of the backing film will dissolve in agitated water at 20°centigrade in under 60 seconds. For the purposes of this invention, however, the time scale may be of the order of several minutes.

The backing layer dissolves directly in water without any chemical modification such as addition of salts to induce thermoreversion to soluble form or adjusting the pH of the water to induce dissolution.

5 Unlike prior art backing layers for catamenial devices and the like, the backing layer of the present invention not only has the necessary barrier qualities to prevent leakage therethrough of the bodily liquid discharge but also is rapidly soluble in water to the extent that it will dissolve within minutes of being introduced into the waste water/sewerage system. In complete contrast to prior art approaches to solving the problem of disposability of catamenial devices in waste water systems, the present invention relies upon selective barrier properties of the material used to construct the barrier layer.

15 It has been found that by careful selection, a barrier material may be provided which obstructs passage therethrough of viscous bodily discharges including menstrual fluid, blood and breast milk, all being highly proteinaceous fluids, while being swiftly and comprehensively soluble in water.

20 Where alginate is used to form the backing layer it is suitably in the correct ratio of calcium salt to sodium salt for adequate solubility in the water of the sewerage system without reducing the effectiveness of alginate as a barrier to passage therethrough of the viscous bodily liquids.

25 In order to provide a further degree of control over the integrity of the backing layer in, for example, relatively high humidity and high temperature tropical or sub-tropical environments, modified coatings may be applied in a continuous form to the external face of the backing layer. In one example, the discontinuous coating is formed as a thin matrix on the external face of the backing layer.

30 A further significant technical improvement of the present invention involves use of the relative solubility in water of the backing layer to adhere the perimeter of the backing layer to another structural component of the

composite article. In the case of a sanitary napkin the other component of the composite article is the coverstock and the bonding action is achieved by lightly applying water to the interface between the backing layer and coverstock.

5 In a further technical and inventive improvement over the prior art, the absorbent core of the product may be formed of a wad of alginate fibres which adhere to the backing layer upon a light application of water to the backing layer.

10 It should be appreciated, of course, that the use of the backing layer as the glue upon application of water requires very sparing use of the water to avoid disintegration of the layer since it is inherently wholly water soluble. For this purpose, the water is probably best applied as a fine mist.

15 In a further technical improvement, the backing layer is suitably formed in a casting process in which it is cast onto a roughened or embossed surface to provide a corresponding roughened or embossed surface to the backing layer. Such a roughened or embossed surface to the backing layer enhances the positional stability of the product in use. For example, in the case of the sanitary napkin, the roughening of the external surface will assist to hold the napkin against the undergarment of the wearer without use of, or with  
20 reduced use of, external adhesive.

Reduction in use of a non water soluble or non water dispersable adhesive is highly desirable to enhance the dispersability and biodegradability of the product as a whole.

#### A Brief Description Of The Drawings

25 Preferred embodiments of the present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, wherein;



Figure 1 is a transverse sectional view of a sanitary napkin embodying the invention;

Figure 2 is a plan view of a backing layer of the figure 1 embodiment;

5 Figure 3 is a transverse sectional view of a second embodiment of sanitary napkin;

Figure 4 is a transverse sectional view of an alternative configuration of backing layer.

#### Description of the Preferred Embodiments

10 Referring to figures 1 and 2, the illustrated sanitary napkin comprises a core 2 consisting of an absorbent pad of a superabsorbent material such as paper and carboxymethylcellulose encased between a coverstock web 1 and a backing layer 3.

15 The coverstock web 1 is suitably biodegradable and most preferably, in common with the backing layer 3, is water soluble and may suitably be formed of the same material as the backing layer 3.

As discussed in the summary of the invention section, the backing layer 3 is formed of a material that serves to provide a barrier to migration therethrough of the viscous bodily discharges, menstrual fluid, that the sanitary napkin is designed to absorb and contain.

20 Trials carried out with 20 micron thick polyvinyl alcohol films hydrolysed to a level of 95% (the polyvinyl having been formed from polyvinyl acetate and the residual acetyl groups hydrolysed) demonstrate effective barrier efficiency of the films to retain a 10 millilitre volume of menstrual fluid whereas a single millilitre drop of water will completely dissolve a hole  
25 through the film.

5 In subsequent trials of film solubility in water, the film of 20 microns thickness and appropriate size for a sanitary napkin will disintegrate in a beaker containing 350ml of swirling water at 25°centigrade within 25 seconds, will disperse within 42 seconds and will fully dissolve in 99 seconds. At higher temperatures the rate of dissolution is more rapid.

10 The backing film 3 can be given enhanced resistance to the effect of exposure to high humidity and heat environments by the application of a discontinuous coating 4 of material (Fig.2) exhibiting some degree of water resistance. However the coverage of this coating must be controlled so as to not prevent the loss of mechanical strength of the film during disposal. As illustrated in figure 2, the discontinuous coating 4 is formed as a thin matrix. This matrix exposes only discrete areas of the soluble backing layer film 3.

15 The absorbent structure known as the core 2 must also have sufficient integrity in use, yet lose this integrity when exposed to the flushing action typified by a domestic toilet. For example, this core may consist of alginate fibres adhered to the film (indicated in figure 3 by reference 5), of paper bound with a water soluble binder containing superabsorbent material typified by carboxymethyl cellulose (Fig.1), or of absorbent alginate fibres arranged in a mat, with this mat only kept in position by the coverstock 1 to film 3 enclosure. Other example cores might include starch flakes or potato fibres.

20 The binding of the coverstock 1 by its perimeter to the backing film 3 can be achieved by application of heat and moisture, or by means of adhesive. This adhesive is preferably of water dispersable nature. Since the backing film 3 is inherently tacky when lightly sprayed with water, it may be used as the sole means of adhering the coverstock 1 to the backing film 3, thereby not only providing cost economy and ease of manufacture but also reducing the number of components of the composite articles that must be dissolved or dispersed upon disposal.

30 Referring to figure 4, the film 3 used for the products is preferably cast in nature. In this process, where polyvinyl alcohol resin is used, this is blended

with plasticiser in water and then cast onto a roughened or embossed surface which is suitably the belt of a production line, to facilitate fully automated manufacture. This method enables the production of film which has a surface texture to it without the need for a subsequent embossing process.

5 As discussed previously, this embossing of the film 3 to provide it with protrusions 6 on its surface which will serve as the external surface of the sanitary napkin promotes the grip of the napkin against the undergarments of the wearer and further reduces or eliminates the need for any adhesive that would otherwise be used for positioning stability of the sanitary napkin.

10 Although the present invention has been described above with respect to a limited number of preferred embodiments, numerous alternative embodiments are conceivable within the scope of the invention and clearly include the use of materials for the backing layer other than polyvinyl alcohol. Furthermore, for the avoidance of doubt, the core 2 need not be  
15 fully encased within a coverstock 1 or other wrapping but may, for example, simply be bound to the backing layer 3.

Although it is preferred that all materials of the composite of the present invention are biodegradable and water soluble, at its simplest the invention simply requires that the backing layer be sufficiently water soluble to enable  
20 rapid dispersal of the product once deposited in a waste water disposal system by, for example, flushing the article away through a domestic toilet.

Claims

1. A water-dispersable bodily liquid absorbent composite comprising a bodily liquid absorbent core and a backing layer which is applied, in use, to at least one face of the core and has no continuous substantially water insoluble barrier therein or thereon and which layer is directly rapidly soluble in cold water without addition of any other agents to induce or enhance solubility but insoluble in viscous low volume bodily liquid discharges, including menstrual fluid, blood and breast milk especially, and being selected from the group consisting of: polyvinyl alcohol hydrolysed to a level of between 90% and 98%; alginate; ethyl cellulose; hydroxypropylcellulose; methyl hydroxypropylcellulose; and hydroxy methyl cellulose.
2. An absorbent composite as claimed in Claim 1, wherein the backing layer is of polyvinyl alcohol which has been hydrolysed to a level of not less than 95%.
3. An absorbent composite as claimed in Claim 2, wherein the backing layer incorporates a plasticiser in an amount of between 5 and 29% and preferably approximately 22% of the dry weight of the backing layer.
4. An absorbent composite as claimed in any preceding Claim, wherein the absorbent core is bonded to the backing layer by lightly applying water to the surface of the backing layer at the interface between the backing layer and the coverstock.
5. An absorbent composite as claimed in any preceding Claim, wherein the absorbent composite further comprises a coverstock and said coverstock is bonded to the backing layer by lightly applying water to the surface of the backing layer at the interface between the backing layer and the coverstock.

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6. An absorbent composite as claimed in any preceding Claim, wherein the backing layer is formed in a casting process in which it is cast onto a roughened or embossed surface to provide a corresponding roughened or embossed surface to the backing layer.
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